SURGICAL SAW BLADE COUPLER

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present application claims priority to U.S. Provisional Application Serial No. 60/425,461, filed November 12, 2002 (Attorney Docket No: 60,210-144).

FIELD OF THE INVENTION

[0002] The present invention relates generally to powered surgical cutting devices, and more particularly, to a surgical saw blade coupler for releasably holding a surgical saw blade.

BACKGROUND OF THE INVENTION

[0003] It is common to use powered surgical cutting devices during surgical procedures. Generally, these devices have a handle. An electric or pneumatic motor is contained within the handle. The motor drives, in a cyclical fashion, a driver. One end of a surgical blade is releasably coupled to the driver. The other end of the blade includes a cutting edge with a plurality of teeth. The surgical blade may be of various shapes, e.g., for crescentic or straight and, typically, may be mounted to the driver in various positions. Commonly, the surgical blades are interchangeable and disposable.

[0004] Generally, a clamping structure is used to releasably couple the blade to the driver. When force is applied to the cutting edge of the surgical blade the force is transferred to the opposite end of the blade. This may have the effect of compromising the clamping structure, resulting in an unintentional release or slippage of the saw blade.

[0005] One device aimed at overcoming this problem is disclosed in US Patent 5,658,304 issued August 19, 1997 to Joepert Lim (the '304 patent). The device disclosed in the Lim patent includes a cutting element with two flanges and a handpiece with a base surface and a groove adjacent the base surface. When coupled together, one of the flanges engages the base surface and the other flange engages the groove. However, the addition of a second flange to the saw blade, increases the complexity of the saw blade and thus the cost of the saw blade.

[0006] The present invention is aimed at one or more of the problems as set forth above.

SUMMARY OF THE INVENTION AND ADVANTAGES

[0007] A surgical saw blade coupler for removably holding a surgical saw blade. The surgical saw blade may be of various shapes and sizes, including, but not limited to straight or crescentic. The surgical saw blade coupler includes a cap, a pin and a driver. The driver is rotatably coupled to a motor within a housing. The cap and the pin form a slot which receives a first end of the surgical saw blade. The cap and the pin also form a groove for receiving a back edge of the surgical saw blade. The surgical saw blade coupler is moveable between an open position in which the surgical saw blade may be removed, exchanged or inserted, and a closed position.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] Other advantages of the present invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

[0009] Figure 1 is an isometric view of a surgical saw blade coupler for use with a surgical saw blade, according to an embodiment of the present invention;

[0010] Figure 2 is side view of the surgical saw blade coupler of Figure 1;

[0011] Figure 3 is a cut-away drawing of the surgical saw blade coupler of Figure 1 and a straight saw blade;

[0012] Figure 4 is a view of a first end portion of a saw blade for use with the surgical saw blade coupler of Figure 1;

[0013] Figure 5 is a top down view of a pin of the surgical saw blade coupler of Figure 1, according to an embodiment of the present invention;

[0014] Figure 6 is a side view of the pin of Figure 5;

[0015] Figure 7 is an enlarged view of the surgical saw blade coupler of Figure 1 in an open position;

[0016] Figure 8 is a top view of a driver of the surgical saw blade coupler of Figure 1, according to an embodiment of the present invention;

[0017] Figure 9 is a side view of the driver of Figure 8;

[0018] Figure 10 is a side view of the surgical saw blade coupler and a crescentic saw blade, according to an embodiment of the present invention;

[0019] Figure 11 is a cut away view of the surgical saw blade coupler and the crescentic saw blade of Figure 10;

[0020] Figure 12 is an isometric view of the crescentic saw blade of Figure 11;

[0021] Figure 13 is a bottom view of the crescentic saw blade of Figure 11; and,

[0022] Figure 14 is an enlarged view of a portion of the surgical saw blade coupler of Figure 1, according to an embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0023] With reference to the drawings, and in operation, the present invention provides a surgical saw blade coupler **10** for use with a surgical saw blade **12**. As discussed below, the surgical saw blade **12** may be of various shapes and sizes, such as a crescentic blade or a straight blade. The surgical saw blade coupler **10** is partially, rotatably contained within a housing **14** and is coupled to a motor (not shown) contained within the housing **14**. The motor may be of any suitable type, e.g., pneumatic or electrical. The motor provides motion to the surgical saw blade **12**. In one embodiment, the motor provides cyclical linear motion. In another embodiment, the motor provides cyclical angular motion (as shown by the arrow **16** in Figure 1).

[0024] With specific reference to Figures 1, 2, 3 and 7, in one embodiment, the coupler **10** includes a cap **18**, a pin **20**, and a driver **22**. The coupler **10** is movable to and between an open position, as shown, in Figures 1, 2 and 7, and a closed position, as shown in Figure 3. When the coupler **10** is in the open position, the surgical saw blade **12** may be removed, positioned or inserted into the coupler **10**. The coupler **10** may be moved to the closed position to secure the surgical saw blade **12** in place.

[0025] As shown in Figures 5 and 6, the pin **20** has an upper portion **24**, a circular portion **26**, and a bottom portion **28**. The upper portion **24** has a cylindrical shape including a top portion **30** and a coupling portion **32**. The top portion **30** has a slightly smaller diameter then the coupling portion **32**. As shown in Figures 1 and 7, the cap **18** includes a cap aperture **34** which receives and secures the coupling portion **32**. In one embodiment, the pin **20** and the cap **18** are secured together by a press fit between the cap **18** and the coupling portion **32** of the pin **20**.

[0026] Returning to Figures 5 and 6, the circular portion **26** has a circular outer edge **36**. As shown, the circular portion **26** includes a plurality of pin apertures **38**. In the illustrated embodiment, the circular portion **26** includes four pin apertures **38A**, **38B**, **38C**, **38D**. In one embodiment, each aperture **38** has first and second arcuate sides **40A**, **40B** and first and second linear sides **42A**, **42B**.

[0027] When joined together, the cap **18** and the circular portion **26** of the pin **20** form a coupler slot **44** which receives the surgical saw blade **12**.

[0028] With reference to Figures 2, 7, 8 and 9, the driver **22** includes a driven portion **46** and a locking portion **48**. In the illustrated embodiment, the driven portion **46** includes first and second prongs and is adapted to couple with the motor and to translate motion from the motor to the coupler **10**, and hence, the surgical saw blade **12**.

[0029] The locking portion **48** includes an upper surface **50** and at least one locking member **52** located on the upper surface **50**.

[0030] In the illustrated embodiment, the locking portion **48** includes four engaging members **52A**, **52B**, **52C**, **52D**. As shown, each engaging member **52** has a general curved U shape. Each engaging member **52** further has first and second engaging prongs **54A**, **54B** and a central engaging portion **56**.

[0031] When the coupler **10** is in the closed position, portions of the first and second engaging prongs **54A**, **54B** and the central engaging portion **56** of each engaging member **52** fit through one of the pin apertures **38** of the pin **20**.

[0032] In one illustrated embodiment, the surgical saw blade **12** is a straight blade, as shown in Figures 3 and 4. The surgical saw blade **12** has a first end **58** which slides into the coupler

slot **44** and is locked into place by the coupler **10** (see below). A second end **60** includes a cutting edge **62** having a plurality of teeth **64**.

[0033] With particular reference to Figure 4, the first end **58** includes a blade slot **66** and a plurality of blade apertures **68**. In the illustrated embodiment, the first end **58** includes five blade apertures **68A**, **68B**, **68C**, **68D**, **68E**. The blade apertures **68** are shaped to receive one of the engaging prongs **54** of the locking members **52**.

[0034] With the coupler **10** in the open position, the surgical saw blade **12** may be inserted into the coupler slot **44** formed between the cap **18** and the pin **20**. The blade slot **66** slips around the coupling portion **32** of the pin **20**. The surgical saw blade **12** may be positioned within the coupler slot **44** such that the blade apertures **68** align with the engaging prongs **54** of the locking members **52**.

[0035] Once the surgical saw blade **12** is in position, the coupler **10** may be closed or moved to the closed position. With particular reference to Figure 14, which is an enlarged view of the coupler **10** and surgical saw blade **12**, when the coupler **10** is in the closed position. As shown, the coupling portion **32** of the pin **20** forms a ledge **70**. The cap **18** rests on the ledge **70** forming a back portion **72** of the coupler slot **44** with the circular portion **26** of the pin **20**. The surgical saw blade **12** is inserted into the coupler slot **44**.

[0036] The first end **58** of the surgical saw blade **12** has a width, X, which is slightly smaller than the width, Y, of the second groove **74**. For example, in one embodiment, the surgical saw blade **12** has a width of 0.025 inches and the second groove **74** has a width of 0.027 inches.

[0037] When a force is applied to the surgical blade **12** in the direction of arrow F1 or F2, the surgical saw blade **12** tilts within the coupler slot **44**. While the surgical saw blade **12** is

tilted it is in contact with the coupler slot **44** at two points. One of the corners of the back portion **72** of the surgical saw blade **12** is in contact with either the cap **18** or the pin **20**. And a point on the opposite side of the surgical saw blade **12** is in contact with the other of the cap **18** or the pin **20**. This helps to prevent further movement of the surgical saw blade **12** within the coupler **10** and to prevent the applied force from opening the coupler **10**.

[0038] Additionally, the locking members **52** are inserted through the pin apertures **38** in the pin **20**. Furthermore, at least one of the engaging prongs **54** is inserted through one of the blade apertures **68** in the first end **58** of the surgical saw blade **12**. In the illustrated embodiment, five of the engaging prongs **54** are inserted through the blade apertures **68** in the first end **58** of the surgical saw blade **12**. First and second pairs of these engaging prongs **54** are associated with two locking members **52**. An upper surface of the central engaging portion **56** engages or is contact with a surface of the first end **58** of the surgical saw blade **12**. This serves to lock the surgical saw blade **12** in place between the cap **18** and the pin **20** when the surgical saw blade coupler **10** is in the closed position.

[0039] With reference to Figures 10, 11, 12, and 13, the surgical saw blade **12** is shown as a crescentic saw blade **12'**. The crescentic saw blade **12'** has a curved body portion **76** with a first end **58'** and a second end **60'**. The first end **58'** has a cutting edge **62'** with a plurality of teeth **64'**. A base **78** is connected to the second end **60'** of the crescentic saw blade **12'**. The base **78** includes a blade slot **66'** and a plurality of teeth **64'**. The base **78** is similar to the second end **60** of the straight blade **12** detailed above and operates in a similar manner.

[0040] In one embodiment, the surgical saw blade **12, 12'** are composed from stainless steel.

[0041] Returning to Figure 3, the coupler **10** further includes a bearing **80** inserted into a housing aperture **82** within the housing **14**. A cup **84** is inserted within the center of the

bearing **80**. The cup **84** has a first end **86** and a second end **88**. The first end **86** includes a cup aperture **90**. A lip **92** is located at the second end **88**. The bottom portion **28** of the pin **20** passes through the cup aperture **90**. The lip **92** rests against the bearing **82** and prevents further inward (to the left in Figure 3) movement of the cup **84**. A button **94** having a press fit with the bottom portion **28** of the pin **20** is inserted between the bottom portion **28** and the cup **84**. A biasing spring **96** is located between the button **94** and the first end **86** of the cup **84**. The biasing spring **96** acts against the button **94**, and thus, the pin **20**, to bias the pin **20** to close the coupler **10**. In the illustrated embodiment, the biasing spring **96** acts to close the coupler **10**. To insert, remain, and/or exchange blades **12, 12'** the cap **18** and pin **20** are manually opened (against the force exerted by the spring **96**) by pushing on the button **94**. After the blade **12, 12'** is removed and/or inserted, the spring **96** acts to close the coupler **10**, thus locking the blade **12, 12'** in place.